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Attached, as information, is a copy of the translation of reference DE 7341620 which is cited in the actions for this application.

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TRANSPARENT TANK OF FIBER-GLASS REINFORCED REACTION RESIN MOLDED MATERIAL

[Transparenter Tank aus glasfaserverstärktem Reaktionsharzformstoff]

[none listed]

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APPLICANT	(71):	BASF AG
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[First page of source document is part of the filing for this utility model –all relevant information is included in the title page of this translation.]

A conventional storage tank for storing combustible liquids is welded together of steel plate. A considerable disadvantage of said steel tank is the strong susceptibility thereof to corrosion: combustible liquids, heating oil and gasoline, in particular, contain more or less finely distributed water, chlorides etc. Based on this unwanted, yet unavoidable impurity, corrosion (pitting) develops principally in the lower region of the tank, which as a rule becomes a leak after several years and consequently can lead to a failure. /2*

For a buried tank in particular, an additional strong corrosive effect comes from the outside by means of the surrounding, moist ground and/or creeping current.

For reasons of preserving the purity of ground water, legislators therefore have prescribed, double-walled construction with leakproofing indicators against internal corrosion for steel tanks and suitable grounding and insulation against external corrosion.

The use of a noncorrosive material, e.g., a fiber-glass reinforced plastic as a tank wall material suggested itself. Successfully in use today, e.g., are fiber-glass reinforced polyester resins for above-ground and underground storage tanks for heating oil and diesel fuel with capacities up to 100,000 liters.

The advantages of GRP tanks lie, above all, in the high level of corrosion resistance and weathering resistance, in the low weight, and also in the transparency of the material. Of disadvantage, for the storage of combustible liquids of Group A, Hazard Category I and II and B, are the high electrical /3

* [Numbers in right margin indicate pagination of the original text.]

surface resistance of approximately 10^{14} Ω and the thereby possible electrostatic charge of the surface. Static electricity already was the frequent cause of fires and explosions. However, various measures precisely for GRP materials can control this hazard.

If the surface resistance is under 10^9 Ω measured according to VED 0303 Part 3 [VDE = Verband der Elektrotechnik Elektronik Informationstechnik, the Association for Electrical, Electronic & Information Technologies] and the bleeder resistance is less than 10^6 Ω according to DIN 51 953, no electric charge on solid bodies is to be expected. Materials having a surface resistance of up to 10^{11} Ω also still can be drawn on for certain applications.

A multitude of possibilities are indicated in the literature of how to prevent the ignition hazard provoked by electrostatic charge. Important details are given here, above all, by the "guidelines for the prevention of hazard as a result of electrostatic charge" of the Accident Prevention & Insurance Association of the chemical industry. However, if one starts from the precondition of manufacturing a GRP tank, the electrostatic behavior of which is to equal that of a metal vessel, then the only measures that remain are those directed at the material itself. The aim therefore is to lower the surface resistance to below 10^9 Ω and the bleeder resistance to below 10^6 Ω. An additional possibility for preventing ignition hazard caused by electrostatic charge consists in embedding electrically conductive grating, metallic networks or metallic non-woven material in the material at a distance of 0.25-2 mm from the surface (compare Kunststoffe, Bd. 59, Heft 12, s. 838-842).

Conductive, grounded networks inserted in the tank wall have the advantage, above all, that the tank walls can remain transparent or can be dyed any color. Apart from conductive grating, metallic non-woven material or other conductive non-woven material also can be used, provided that the decrease, or loss, of transparency is not a disruption.

The surface resistance of GRP can be abated by means of an addition of conductive filler materials (metallic powder, carbon black, graphite, among others), by means of conductive fibers or static inhibitors. Such filler material additives have the disadvantage of producing dark and nontransparent parts; this prevents recognition of defects in the laminate of the tank wall, either from outside or inside. Conductive fibers located at the surface are easily destroyed during inspection by means of corrosive influences, among others. Static inhibitors consume themselves with time and consequently do not bestow an enduring effect. /4

In order to make sure as much as possible, the physical-technical federal agency in Braunschweig proposes, for substances of Group A Hazard Category II, a maximum mesh width of 8 x 8 cm, an embedding depth of maximum 2 mm, for substances of Group A Hazard Category I, a maximum mesh width of 4 x 4 cm and an embedding depth of a maximum 0.25 mm. In practice, work is done with even denser networks as these allow for improved manipulation and thus, one makes sure in any case.

Suitable as conductive gratings are wire networks, gratings of metalized synthetic fibers, fiber-glass fabrics with woven-in metallic threads, graphitized synthetic fiber fabrics, among others. The grating, incorporated in a suitable way during manufacture of the tank outer wall, is located for a buried tank, up to a maximum of 2 mm below the inner tank surface; for an above-ground tank, in addition, at an identical maximum distance from the exterior surface.

Transparent heads can be manufactured according to the known manufacturing methods such as compression, fiber-spraying, hand lamination, injection methods, among others, in the same way by means of inserting conductive gratings, non-woven materials and similar, for the aforementioned storage tanks for combustible liquids of Group A, Hazard Category I and II as well as B.

The conductive fibers of a very slight cross section, terminating at the edge-planed tank head edge must be joined with the fiber ends of the grating located at the tank outer wall in a conductive way to a /5

tank and grounded outwards. For this reason, one heretofore managed, during head manufacture, with the use, e.g., of a graphite-containing, i.e., conductive, resin bonding agent; however, the transparency would be lost.

Now it has been found that the requirements necessary for above-ground and underground storage of combustible liquids of Group A, Hazard Category I and II (e.g., gasoline) and of Group B (according to VbF [Regulation on combustible liquids]) are fulfilled by means of GRP storage tanks for which a conductive connection is present between head grating inserts and cylinder grating inserts, which is characterized by means of the fact that a voluminous conductive non-woven material, e.g., a metallic non-woven material covered, if necessary, by means of additional laminate layers, is arranged as a strip on the edge of the conductive grating toward the nearest surface such that present across a plurality of fibers of the voluminous, conductive non-woven material is an electrically conductive connection between the grating insert and tank surface and the head and outer wall of the transparent tank are connected to each other by means of an external, conductive laminate.

Suitable conductive voluminous non-woven materials are loose metallic non-woven materials, e.g., non-woven materials of steel, stainless steel, brass or other metal alloys, moreover, non-woven materials of metalized or graphitized fibers, generally featuring a layer thickness of 0.1-2 mm, preferably 1 mm.

If one wishes to ground, e.g., for a buried tank, the grating in an outward direction toward the soil, then only a wider, conductive, voluminous non-woven material need be arranged such that it initially projects beyond the edge of the grating and simply is collapsed over the preform or glass mat insert toward the tank surface away from the grating, i.e., the future external tank surface. This can take place both during manufacture of the head as well as prior to application of the last laminate layer during manufacture of the outer wall. Now, in order to achieve conductive contact, conductive surfaces can be

produced during tank assembly/installation by means of grinding, in the region of the location of the joint tank outer wall/head, the pre-fabricated part, connecting the outer wall and head in a conductive /6 way in a simple manner by means of a corresponding laminate and producing electric conductivity between the grating and the surrounding soil. The chamber form claimed here is illustrated using the example of a transparent GRP storage tank for storing combustible liquids of Group A (Hazard Category I and II) and B in 3 drawings and is expounded upon in the following:

Figure 1 Shows a transparent GRP storage tank,

Figure 2 Shows the connection between head and cylinder in section,

Figure 3 Shows another possibility for a connection head/cylinder, in section.

The tank is composed of a length (1) manufactured, e.g., using a winding method, of a generally cylindrical cross section (Figure 1), two heads (2) manufactured, e.g., by pressing and laminated or glued thereto and an electrically conductive manhole port (3). Wound length and heads are transparent and contain conductive gratings (4) connected in a conductive manner by means of a laminate (5) to the locations of the joints cylinder/heads. The manhole port is connected to the laminate (5) by means of an electrically conductive laminate (6) or another conductor.

The wound length is composed of a reaction resin, e.g., an unsaturated polyester (UP) resin as the bonding agent and reinforcing fibers, e.g., fiber-glass fibers. After the first layer of fiber-glass mat, non-woven material or similar (7) (Figure 2) is inserted a conductive grating (4) at a distance of 0.2 mm to a maximum of 2 mm from the inner surface. This conductive grating projects beyond the ends of the length, in each case, by several cm. Further construction of the wound length is carried out in the usual manner, e.g., by means of roving wound layers (8) alternating with planar fiber-glass reinforcements (9).

For the head (2) (Figure 2), the conductive grating cannot, as a rule, project beyond the edge for procedural reasons, as [it does] for the wound length. Therefore, during the manufacture thereof, e.g., during pressing, a one to approximately 40 cm wide strip of a conductive, voluminous non-woven /7
material, e.g., metallic non-woven material, is inserted at the exterior upper edge of the preform or similar in such a way that approximately half of said non-woven material is located on the preform (10) and the other half (10a, 10b) projects beyond the edge. The conductive grating (4) is placed in the preform or similar and the projecting edge of the non-woven material (10a and b) are folded toward the interior of the head in such a way that the conductive non-woven material comes to be located directly on the grating (10b). The grating still is covered toward the interior in such a way by a glass non-woven material, a glass mat or similar (11) in such a way that the grating is located a maximum of 2 mm below the interior surface of the head. After being manufactured, the head now can be ground on the edge thereof without forfeiting the outward conductivity of the grating located in the interior.

Assembly of head and tank length is carried out such that the projecting grating at the end of the length is reversed (4a) and the head is butted against the wound length with a conductive adhesive (12) on the joint edge, if necessary. A conductive laminate (5) connects head and wound length in a force fit. The area covered by the laminate must be ground beforehand.

Similar to manufacture of the head, in lieu of a projecting grating (4a), a voluminous, conductive non-woven material can be arranged between (7 and 4) according to Figure 3, likewise that projects laterally. The non-woven material is reversed (13a) before the last external laminate layer and the last laminate layer is deposited. Before assembly of the head to the cylinder, the ends of the wound length are ground. The conductive surface is manufactured again in this way. Further assembly is carried out as already described in the example of Figure 2.

Claims /8

1. Transparent storage tank for above-ground or underground storage of combustible liquids, featuring a conducting connection between the conductive head and cylinder grating inserts or non-woven material inserts, characterized in that a voluminous conductive non-woven material, covered, if necessary, by means of additional laminate layers, is arranged on the edge of the conductive grating toward the next surface in such a way that an electrically conductive connection is present between grating insert and tank surface by means of a multitude of fibers of the voluminous conductive non-woven material, and head and outer wall of the transparent tank are connected to each other by means of an external, conductive laminate.

2. Transparent tank according to Claim 1, characterized in that graphitized synthetic fiber fabric is utilized as the conductive grating.

3. Transparent storage tank according to Claim 1, characterized in that a metallic non-woven material is utilized as the conductive, voluminous non-woven material.

4. Transparent storage tank according to Claim 1, the heads of which are connected to the tank outer wall by means of a conductive laminate, characterized in that graphitized glass non-woven material, graphitized glass mat and/or graphitized glass fabric is used as the reinforcing fibers.

Drawings

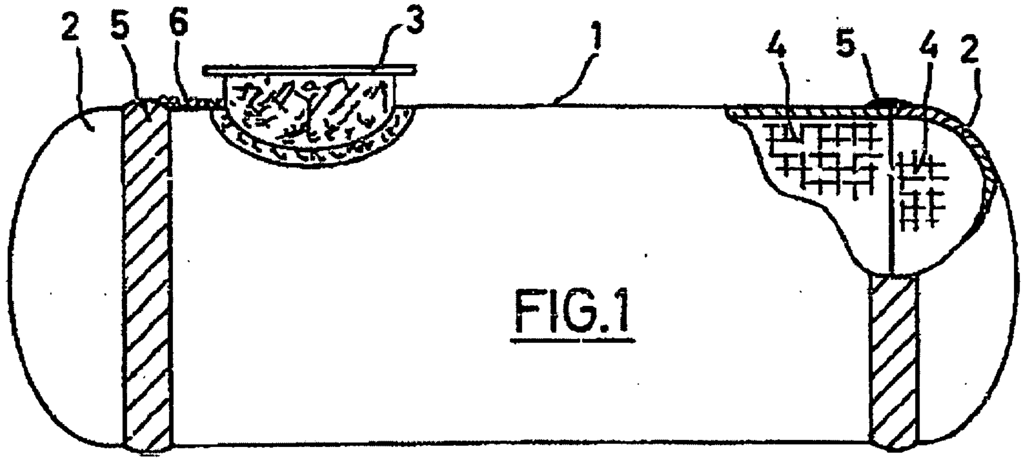

FIG.1

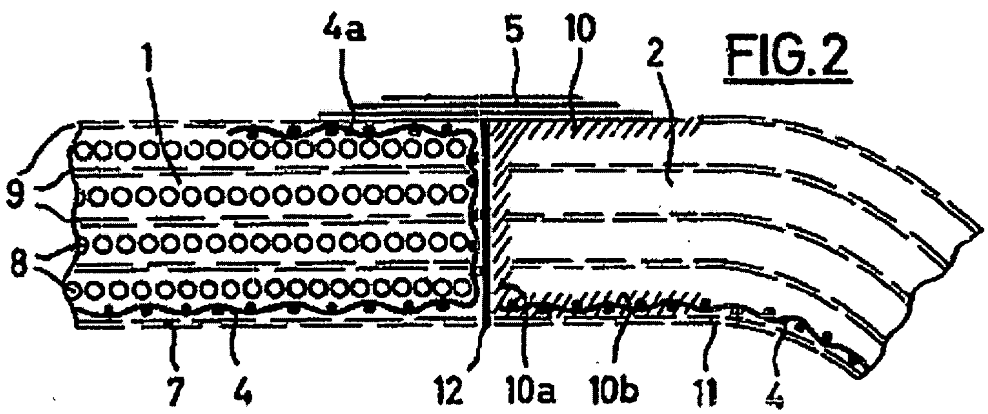

FIG.2

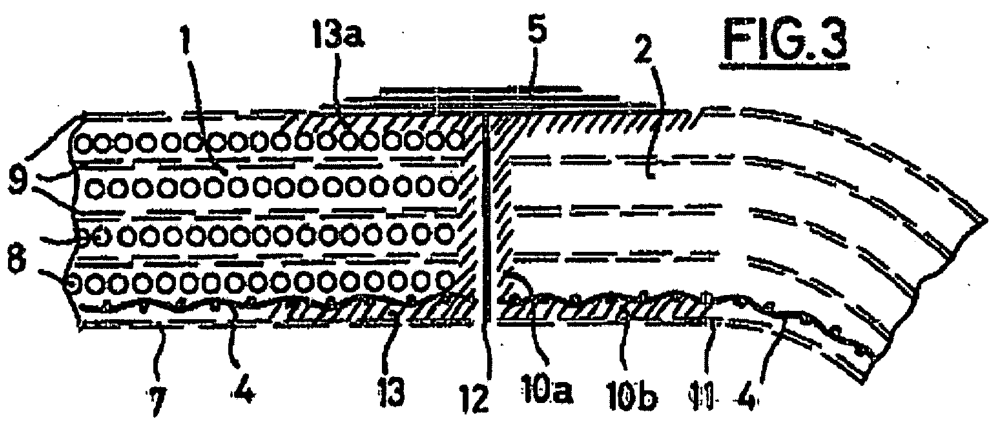

FIG.3